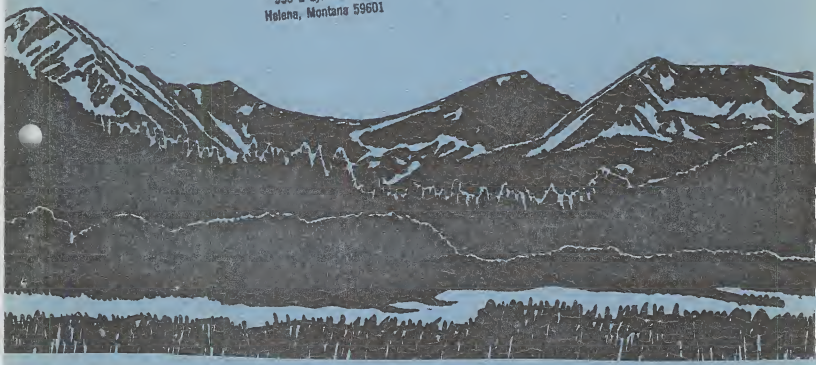
BIG SKY LAB BENCH



ANNUAL REPORT for FISCAL YEAR 1976

MONTANA

Department of Health and Environmental Sciences

Laboratory Division

David B. Lackman, Ph.D., Administrator

ON THE OCCASION OF MILTON (BUD) BROWN'S RETIREMENT FROM THE LABORATORY, THIS ANNUAL REPORT IS DEDICATED TO BACTERIOLOGY AND BACTERIOLOGISTS SERVING MONTANANS THROUGH THE STATE BOARD OF HEALTH AND THE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES.

It all started on May 22, 1901, at a meeting of the Board in Governor Toole's office when Dr. Emil Starz was appointed State Bacteriologist and Dr. Longeway, Secretary of the Board, was instructed to get the necessary equipment to carry on the work. Dr. Starz was the first professional public health worker, other than the Executive Secretary, to be employed by the State. Dr. Starz had obtained degrees in chemistry and pharmacy in Europe. The first work was done in a back room of his drug store on Rodney Street. Culturing for the diphtheria bacillus was followed by cultures for tuberculosis and typhoid fever. Environmental bacteriology came next with testing of water and milk for the health department and also for the livestock people. At some time the work was moved to the old livestock building south of the Capitol heating plant. In the minutes of the Board for November 21, 1914, a notation is made that the bacteriological laboratory under Dr. Starz is becoming increasingly popular and that the laboratory should be enlarged and the scope of the work increased. In the minutes for April 16, 1917, note is made of a letter of resignation from Dr. Starz as State Bacteriologist. However, he was still doing work for the Livestock Sanitary Board in 1922. Dr. Starz's interests were not confined solely to microbes. He invented a urine analysis machine which he donated to the government and he also did research on vitamins.

My predecessor, Miss Edith Kuhns, pursued work in bacteriology in the State Laboratory for 42 years and two months; from June 1925 to August 31, 1967. For 32 years she served as the Laboratory Director (September 11, 1935 - August 31, 1967). This period saw the construction and outfitting of the W. F. Cogswell State Laboratories Building. Growth of responsibilities in the public health laboratory was overwhelming during this period; and Miss Kuhns met the challenge.

Milton Brown, whose retirement on September 30, 1976 we are recording, started his career in the Board of Health in 1942 as a junior chemist in the water laboratory of the Division of Sanitary Engineering. In 1951, Bud transferred to the Hygienic Laboratory. During his career in this laboratory, he became one of the outstanding determinative bacteriologists in the country. The Center for Disease Control, for the past several years, has utilized Bud's acumen in this specialty by having him serve as one of two or three reference laboratories for their proficiency tests in bacteriology. Throughout his thirty-four years with the State of Montana, Bud has been the model public servant - putting service to Montanans above service to self. We all wish him well in his retirement.

David B. Lackman

David B. Lackman, Ph.D., Administrator
Laboratory Division, Department of Health
and Environmental Sciences September 14, 1976

INTRODUCTION

Activities in the Bureaus are divided into the following components. The name listed is that of the person having major professional responsibility for the activity.

CHEMISTRY LABORATORY BUREAU - Walter A. Jankowski, Chief

Michael Harrington	:	Alcohol and Abused Substances
Thomas Daly	:	Food & Consumer Safety, Occupational Health
Warren Norton	:	Air Pollution
John Hawthorne	:	Water Pollution Control and Drinking Water Supplies

MICROBIOLOGY LABORATORY BUREAU - Milton Brown, Chief (Bud Brown retired October 2, 1976; Mel-Iden Chambers, Acting Chief)

Mel-Iden Chambers	:	Mycobacteriology, Parasitology, and Mycology
John Hall	:	Clinical and Determinative Bacteriology
Ella Mae Howard	:	Sanitary and Environmental Bacteriology (Drinking water, Water Pollution Control, Food & Consumer Safety)
Anne Sallgren	:	Venereal Disease Serology
Robert Clark	:	Virology

There were 20.90 Full-time equivalents budgeted from funds appropriated to the department for the laboratory division. Federal funds underwrote 12.09 of these positions. Total expenditures from the budget of the laboratory division were $360,414. The state general fund provided $144,578, while $215,836 came from federal funds. The estimated population of Montana is 748,000 persons - so the per capita expenditure for public health laboratory services for the year was $0.482. This puts us about at the national average for such expenditures.

Major program accomplishments for the year were :	Specimens tested	FY '76
1. Diagnostic bacteriology	"	20,972
2. Diagnostic mycology and parasitology	"	618
3. Diagnostic virology	"	347
4. Immunology : Syphilis serology	"	32,498
Bacterial, fungal, parasitological serology	"	462
Viral, rickettsial, chlamydial serology	"	23,806
5. Clinical chemistry - infant screening and other	"	12,535
6. Environmental bacteriology(food, drinking water, other water)	"	14,831
7. Environmental chemistry(water,air,food,soil,vegetation,bees,coal)	"	7,442
8. Occupational Safety and Health	"	425
9. Toxicology (heavy metals, alcohol, drugs, poisons, etc.)	"	3,362
	Total specimens	117,198
10. Three formal courses were conducted in the laboratory in Helena (waste-water testing, clinical microbiology)	Total students	46
11. National proficiency examinations in clinical laboratory technology and cytotechnology were given twice	Total candidates	28
12. Public information: Four issues of the Laboratory Bulletin were published - twelve lectures given - Numerous consultations conducted in the laboratory or by telephone		
13. Law-enforcement officers passing proficiency examinations and certified to perform analytical tests on breath for ethyl alcohol (and other voltailes)		240
14. Certified Alco-Analyzer installations in police departments		14
15. Laboratories certified for syphilis serology, clinical bacteriology, or water bacteriology		116
16. Amount of fees for bacteriological testing of drinking water deposited in the general fund		$28,278

CHEMISTRY LABORATORY BUREAU

ANALYTICAL CAPABILITY IN WATER CHEMISTRY (October 1976 Revision)

PARAMETER	METHOD	REFERENCE[1]	FREQ.[2]	NOTES
1. Acidity	Titration with 0.02 N NaOH after H_2O_2 oxidation and boiling	ASTM, p.148 EPA, p.1	E	Added FY'74
2. Alkalinity	(A)Auto.Methyl Orange	EPA, p.5	R	
	(B)Titration with 0.02 N H_2SO_4	SM 14, p.278 EPA, p.3		
3. Aluminum	(A)Atomic Absorption	SM, p.210 EPA, p.78	RI	Added FY'74
	(B)Ferron, Ortho-phenanthroline	USGS, p.44	RI	
4. Antimony	Atomic Absorption	SM, p.210 EPA, p.78	RI	Added FY'74
5. Arsenic	(A)Arsine Generation, Atomic Absorption	EPA, p.78	R	Added FY'74
	(B)Silver Diethyldithio-carbamate	SM, p.62	E	
6. Barium	Atomic Absorption	EPA, p.78	R	Added FY'75
7. Beryllium	Atomic Absorption	EPA, p.78	RI	Added FY'74
8. Biochemical Oxygen Demand	Modified Winkler	SM, p.489 EPA, p.11	R	Modified FY'76
9. Boron	(A)Curcumin	EPA, p.13	R	Added FY'75
	(B)Carmine	SM, p.72	E	
10. Cadmium	Atomic Absorption	EPA, p.78	R	
11. Calcium	(A)EDTA Titration	EPA, p.19	R	
	(B)Atomic Absorption	SM, p.210	R	
12. Chemical Oxygen Demand	Dichromate Reduction	SM, p.489 EPA, p.20	E	
13. Chloramines	Amperometric Titration	Fischer-Porter	E	Added FY'76
14. Chloride	(A)Auto.Mercuric Thiocyanate	EPA, p.31		Added FY'76
	(B)Mercuric Nitrate Titration	SM, p.97 EPA, p.29	R	

PARAMETER	METHOD	REFERENCE[1]	FREQ.[2]	NOTES
15. Chlorine	(A)DPD	SM, p.129	E	Added FY'74
	(B)Amperometric Titration	Fisher-Porter	RI	Added FY'76
16. Chromium	Atomic Absorption	EPA, p.78	RI	Added FY'74
17. Chromium VI	Diphenylcarbazide	SM 14, p.192	E	Added FY'75
18. Cobalt	Atomic Absorption	EPA, p.78	RI	Added FY'74
19. Color	Visual Nessler Method with Aqua-Tester	SM, p.160	R	
20. Copper	Atomic Absorption	EPA, p.78	R	
21. Cyanide	Distillation & $AgNO_3$ Titration or colorimetry (Pyridine-Pyrazolone)	EPA, p.40	E	Added FY'74
22. Dissolved Oxygen	Modified Winkler	EPA, p.51	R	
23. Fluoride	(A)Auto.Complexone Method	EPA, p.61	R	
	(B)Specific Ion Electrode	Orion	R	
24. Hardness	(A)Auto.Calmagite	EPA, p.70	R	Added FY'76
	(B)Titration with EDTA	EPA, p.68	R	
	(C)By Calculation from Ca, Mg Analyses	SM, p.179	R	
25. Iodine	PAO Titration	EPA, p.74	E	Added FY'76
26. Iron	(A)Atomic Absorption	EPA, p.78	R	
	(B)Ferron-Orthophenanthroline	USGS, p.44	R	
27. Lead	Atomic Absorption	EPA, p.78	R	
28. Lithium	Atomic Absorption	SM, p.210	RI	Added FY'74
29. Magnesium	(A)EDTA Method, by difference	SM, p.179	R	
	(B)Atomic Absorption	EPA, p.78	R	
30. Manganese	Atomic Absorption	EPA, p.78	R	Added FY'74
31. Mercaptans	GC with EC Detector	Anal.Chem.	E	In Process
32. Mercury	Mercury Cold-vapor, Atomic Absorption	EPA, p.78	R	Method changed in FY'74
33. Molybdenum	(A)Atomic Absorption	EPA, p.78	RI	Added FY'74
	(B)Dithiol Colorimetric	USGS, p.113	E	Added FY'76
34. Nickel	Atomic Absorption	EPA, p.78	RI	Added FY'74

PARAMETER	METHOD	REFERENCE[1]	FREQ.[2]	NOTES
35. Nitrogen-Ammonia	(A)Auto.Phenolate	EPA, p.168	R	Added FY'75
	(B)Distillation, Nesslerization	EPA, p.159	RI R	Added FY'74
36. Nitrogen-Kjeldahl	(A)Manual Digest., Auto.Phenolate	EPA, p.182	R	Added FY'75
	(B)Digestion & Distillation, Nesslerization	EPA, p.175	RI	
37. Nitrogen-Nitrate	(A)Automated Hydrazine Reduction, Diazotization	EPA 71, p.185 EPA, p.201	R	Added FY'74
	(B)Phenoldisulfonic Acid	SM, p.234	R	
38. Nitrogen-Nitrite	Automated Diazotization	EPA, p.201	E	Automated FY'74
39. Nitrogen-Organic	By Difference (Kjeldahl N-Ammonia N)	EPA, p.201	E	
40. Odor	Panel-Olfactory	SM 14, p.206	E	Added FY'74
41. Oil and Grease	Freon 113 Extraction, Evaporation, Gravimetric	EPA, p.229	E	Modified FY'75
42. pH	pH Meter	EPA, p.239	R	
43. Phenols	4-Amino-Antipyrene	EPA, p.241	E	
44. Phosphate-Ortho	(A)Automated Ascorbic Acid Reduction(Single Reagent)	EPA, p.256	R	
	(B)Stannous Chloride, Ammonium Molybdate	SM, p.530	R	
45. Phosphorus-Total	(A)Persulfate Digestion, Automated Ascorbic Acid Reduction	EPA, p.256	R	
	(B)Digestion, Stannous Chloride-Molybdate	SM, p.530	R	
46. Potassium	Atomic Absorption	EPA, p.78	RI	Added FY'74
47.a.Residue-Fixed	Ignition at 550°C, Gravimetric	SM, p.292	RI	
b.Residue-Total, Nonfilterable(susp.), or Filterable(diss.)	Filtration, Evaporation at 105°C, Gravimetric	EPA, pp.270, 268,266	R	
48. Selenium	(A) H_2Se Generation, Atomic Absorption	EPA, p.78	R	Added FY'74
	(B)Atomic Absorption	SM, p.210	E	
49. Settleable Solids	Imhoff Cone	SM, p.539	E	

PARAMETERS	METHOD	REFERENCE[1]	FREQ.[2]	NOTES
50. Silica (Free)	Phosphomolybdate Blue	SM, p.303	RI	Added FY'75
51. Silicon	Atomic Absorption	SM, p.210	E	Added FY'74
52. Silver	Atomic Absorption	EPA, p.78	RI	Added FY'74
53. Sodium	Atomic Absorption	EPA, p.78	R	
54. Specific Conductance	Wheatstone Bridge	EPA, p.275	R	
55. Strontium	Atomic Absorption	SM, p.210	RI	Added FY'74
56. Sulfate	(A)Automated turbidimetric (B)Gravimetric (C)Thorin Titration	EPA, p.277 SM, p.333 USGA, p.152	R E E	Added FY'75
57. Sulfide	Colorimetric Methylene Blue	SM 14, p.503	RI	Added FY'76
58. Sulfite	Titrimetric iodide/iodate	EPA, p.285	E	Added FY'76
59. Surfactants (MBAS)	Methylene Blue	EPA, p.157	E	
60. Suspended Solids	See Residue, Nonfilterable			
61. Tannin-Lignin	Phosphomolybdic Method	SM, p.346	E	Added FY'73
62. Tellurium	Atomic Absorption	EPA, p.78	E	Added FY'77
63. Tin	Atomic Absorption	EPA, p.78	RI	Added FY'74
64. Total Organic Carbon	TOC Analyzer	Dohrmann EPA, p.236	R	Added FY'74
65. Turbidity	Nephelometric	EPA, p.295	R	
66. Vanadium	(A)Atomic Absorption (B)Gallic Acid Catalytic Oxidation	EPA, p.78 USGS, p.157	RI E	Added FY'74 Added FY'76
67. Zinc	Atomic Absorption	EPA, p.78	R	
68. Algal Assay	EPA bottle test	EPA Algal Assay Manual	RI	Added FY'75

ANALYTICAL CAPABILITY IN WATER MICROBIOLOGY

PARAMETERS	METHOD	REFERENCE[1]	FREQ.[2]	NOTES
69. Coliform, Total	(A) MPN (B) Membrane Filter	SM 14, p.913 SM 14, p.928	R R	
70. Coliform, Fecal	(A) MPN (B) Membrane Filter	SM, p. 669 SM 14, p.937	R R	

PARAMETERS	METHODS	REFERENCE[1]	FREQ.[2]	NOTES
71. Strep. Fecal	(A) MPN	SM 14, p.942	R	
	(B) Membrane Filter-Count and Speciate	SM 14, p. 944	R	
72. Plate Count	Pour Plate Technique	SM 14, p.908	R	
73. Salmonella	Concentrate with MF, Trans. to Enrichment Media	SM 14, p.954	R	
74. Iron Bacteria	Microscopic Examination	SM 14, p.993	RI	

NOTES

1. REFERENCES. SM - "Standard Methods for the Examination of Water and Wastewater", APHA, AWWA, WPCF, 13th Edition, 1971

SM 14 - "Standard Methods for the Examination of Water and Wastewater", APHA, AWWA, WPCF, 14th Edition, 1976

EPA - "Methods for Chemical Analysis of Water and Wastes", U.S.Environmental Protection Agency, 1974 Revision

EPA 71 - "Methods for Chemical Analysis of Water and Wastes" U.S.Environmental Protection Agency, 1971

ASTM - "ASTM Standards, Part 23: Water, Atmospheric Analysis", 1972

USGS - "Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases", Techniques of Water-Resources Investigations of the United States Geological Survey, Book 5, Chapter A1, 1970

Anal.Chem. - Analytical Chemistry Journal article

ORION, DOHRMANN, FISHER-PORTER- Procedures as recommended by equipment manufacturers.

2. FREQ. - R : Analyses which are run on a routine basis. Equipment is permanently set up, standard solutions are kept available.

RI : Analyses which are run infrequently, but could become routine. Equipment is permanently set up, but usually standards are unstable and must be prepared when analysis is run.

E : "Exotic" analyses - run very infrequently. Equipment must be set up and standards prepared for each analysis. Laboratory must be notified at least one day before samples arrive.

EE : There are "exotic exotic" analyses which could be performed if necessary, but have not been done in recent recorded history; they do not appear in the listing.

Water Pollution and Drinking Water Testing

Analytical work in this section totaled 25,445 tests for 56 parameters, performed on 2687 samples of water received from 47 different projects; 653 samples were from drinking water supplies, the remainder were water pollution control samples of various types :

BREAKDOWN OF ANALYSES

pH	980	Iron	1207
Specific conductance	1096	Copper	915
Turbidity	191	Zinc	956
Residue (suspended solids)	306	Lead	872
Calcium	1075	Cadmium	1002
Magnesium	1073	Arsenic	590
Sodium	1096	Manganese	841
Chloride	1067	Aluminum	100
Alkalinity	1057	Selenium	326
Sulfate	1079	Boron	445
Potassium	628	Barium	130
Fluoride	945	Nickel	130
Nitrate	1353	Chromium	330
Ammonia	324	Silver	176
Phosphate (ortho)	972	Mercury	589
Phosphorus (total)	390	Strontium	222
Oil & Grease	70	Lithium	135
Phenols	81	Cobalt	187
Acidity	29	Molybdenum	77
Kjeldahl Nitrogen	219	Vanadium	315
Hardness	1071	Beryllium	93
Dissolved Oxygen	59	Color	27
BOD	68	Silica	103
COD	33	Nitrite	38
TOC (total organic carbon)	285	Sulfide, Tin, Chromium VI, Chloramine, Antimony, Algal Assay, Tannins and Lignins	61

Breakdown by Project

Private drinking water	291
Fluoride in drinking water	267
Public water supplies	95
Hughesville acid mine drainage	81
Old West Study Commission-nutrient and saline seep projects	354
Bureau of Reclamation Nutrient Study	343
Industrial Compliance Monitoring	128
Municipal Compliance Monitoring	98
Tongue River Reservoir Study	167
Yellowstone River-Billings Waste Load Allocation	168

Boulder River	79
Hebgen Lake	60
Poplar River	39
Yellowstone-Tongue Areawide Planning	45
Other	479

It is worth noting that during the month of February, requests were received for analysis of a record 51 different parameters : more than the total laboratory capability in FY 1973!

TRAINING was provided both for and by the chemists this past year:

For : Two chemists attended a week-long training course given by Technicon Instruments Corp. on the operation and maintenance of autoanalyzers, in Tarrytown, New York.

Two chemists attended (and passed) a statistics course during the summer, given at Carroll College.

John Hawthorne attended the AWWA's 1975 Water Quality Technology Conference in Atlanta.

By : Keith Kramlick spent a week in the Water Quality Bureau's Billings lab instructing them in the procedure for phenol analysis.

Mike Etchingham spent a day at the Helena sewage treatment plant instructing them on analytical methods for those parameters required under their discharge permit.

John Hawthorne was interviewed on the topic "Minerals in Drinking Water", one of the first ten weekly YOUR HEALTH radio programs produced by the Department.

A 5-day training course, "The Microbiological and Chemical Analysis of Wastewater" was developed by the Chemistry and Microbiology Laboratory Bureaus in conjunction with the Water Quality Bureau, and presented twice in FY '76 : Nov. 3-7 and May 17-21. An EPA training grant was received in conjunction with the second presentation and used to purchase glassware, supplies, and some equipment for the course. The next offering is tentatively scheduled for the last week in November, and we can foresee this as a permanent offering of our Division.

Laboratory Inspection and certification : On February 23-25, 1976, personnel from EPA Region VIII, Denver, inspected and evaluated the water section of the Chemistry and Microbiology Laboratories and the Water Quality Bureau's field sampling program to "define and provide information concerning laboratory and field sampling capabilities and needs as they pertain to the $106, $402, and Safe Drinking Water Programs, and to assess the general quality of the water quality data currently being generated . . . " Further quotations from the cover letter and evaluation report : *"The(chemistry)laboratory staff should be complimented for their outstanding performance on the analysis of the check samples."*

"The(chemistry)laboratory has a well planned, viable quality assurance plan in practice. Laboratory management has a strong philosophy and active interest in data integrity, which is highly commendable."

"In summary, the(chemistry) laboratory management and staff are highly motivated, conscientious and technically competent. Consequently, it appears that the laboratory is capable of providing excellent analytical support for the §106, § 402 and Safe Drinking Water Programs."

"In conclusion, the State Department of Health and Environmental Sciences laboratory and field staff should be given special recognition for implementing and maintaining an excellent State Water Quality Monitoring Program."

In conjunction with requirements of the Safe Drinking Water Act, the laboratory was requested to propose a "Montana Drinking Water Laboratory Certification Program". Our proposed program has been outlined, but must await legislative action before proceeding further.

Equipment and Personnel : Two major purchases of four instruments were made during the year: Three used autoanalyzers, two single- and one dual-channel, were purchased from St. Peter's Hospital in Helena and used to automate chloride, alkalinity, and total hardness.

A Tektronix 31 programmable calculator with interface to our Varian AA-6 atomic absorption spectrophotomer was first obtained on trial, then purchased. With this piece of equipment we can :

1. Have the calculator internally construct a calibration curve, then print out concentrations for samples after raw data is inputted. Besides saving time, this avoids errors and arbitrary analyst judgment in drawing and using standard curves. (The curve can also be reproduced graphically if necessary.)
2. Input data directly from the AA-6 to the calculator and receive a printout of concentrations while samples are being run (in real time).
3. Program the calculator to receive raw-data on common ion analyses, output concentrations, meq/ℓ, and give a cation-anion balance and standard deviation (Cf. Standard Methods, 14th edition, p. 34). Previously, the analysts waited for the computer report printout to know if they had achieved an acceptable balance or if the sample must be rerun. Now this is known before the data card leaves the lab which reduces turnaround time and computer costs.
4. Program the calculator to perform other data manipulations previously done by hand, e.g. the Food & Consumer Safety program's hamburger analyses.

A continuing need has been to obtain help for the chemists in the non-professional duties that need to be performed in any laboratory, e.g. "washing dishes". This past summer we were fortunate in obtaining two lab aides to help during the yearly "flood" of samples. Permission has recently been received to hire a permanent half-time lab aide. Perhaps in the near future this can be made a full-time position, which will go a long way toward allowing the chemists to concentrate solely on chemistry.

Methods, Q A, Legalisms: Again, diversification, development, and expansion were the rule rather than the exception in water quality analytical capability. As mentioned previously, our autoanalyzer purchases allowed automation of three more commonly-run analyses : chloride, alkalinity, and total hardness. This

left a spare sampler which was used in attempts to automate our analyses of sodium and potassium on the AA-6. The sampler appears to work, but difficulties have been encountered in feeding in the other alkali metal reagents (potassium and cesium, which respectively suppress ionization of the sodium and potassium) at a steady, reproducible rate. This short-coming would probably be overcome with a better pump, but see "needs" below. As a result of assembling materials for our training course, our BOD procedure was modified to conform to the method as taught by EPA. Five new parameters - chloramines, iodine, sulfide, sulfite, and tellurium, were added to our capabilities, and modifications or new methods were introduced for six other parameters. A current listing of capabilities follows this section.

FY 1976 also saw diversification into analysis of fish tissue, soil and sediment, and plant tissue. Since it appears additional samples and further refinement of our methods will occur in FY 1977, a listing of our capabilities in these areas will be published in the next annual report.

A legally defensible chain-of-custody procedure for collection, transport, and storage of samples was drawn up by the Water Quality Bureau, with considerable input from the laboratory. Finally, one of the chemists is serving as expert witness in a court case involving water pollution.

NEEDS: A review of our needs as listed in the FY 1974 annual report shows that, with the exception of a laboratory certification program, our past needs have been met. Current Needs :

* as mentioned earlier, more support staff (lab aides) is necessary
* a larger BOD incubator
* autoanalyzers for total metals digestion and MIBK-APDC extractions
* a small flame photometer or atomic emission photometer for sodium and potassium, to free time on the AA-6 for the other metals
* a second atomic absorption unit with the sensitivity of the AA-6, or a simultaneous multi-element plasma emission spectrometer.
* Metals are creating our biggest backlog and preventing sample turnaround time from being reduced. These pieces of equipment would assist us greatly in our efforts to move toward a large-volume, production-type laboratory.

Finally, more space is needed : five people, soon to be 5 1/2, plus instruments, are crowded into inadequate space. The EPA evaluation team strongly recommended the securing of additional room for water quality analysis. However, the current crowded conditions in this department probably rule out any immediate expansion and, outside of hiring only skinny people, we will have to make do with the present situation for a while.

Air Quality Chemistry

This year, 4767 analyses were performed on 4208 samples as follows:

Parameter	Sample form	Samples	Determinations	
Fluoride :	fluoride papers	452	452	
	fluoride plates	372	372	
	fluoride sampler tapes	799	799	
	fluoride in Vegetation	226	226	
	fluoride in stack test samples	5	5	
	fluoride impingers	21	21	
	fluoride in pond water	1	1	
	Sulfur dioxide plates	269	269	
	Sulfur dioxide bubblers	255	255	
	nitrogen dioxide bubblers	224	224	
	Hivol samples - total suspended particulate	1283	1283	
	Anderson - particle sizing	20	20	
	Hivol samples - metal determinations	65		
	for: lead		65	
	zinc		45	
	cadmium		65	
	iron		20	
	Stack testing samples - Colstrip #1, Montana Dakota Utilities	22		
	for: sulfur dioxide		8	
	nitrogen dioxide		8	
	arsenic, cadmium, copper lead, strontium, chromium, zinc, manganese, beryllium		6	each parameter
	Coal	108		
	for: BTU		50	
	% Ash		46	
	% water		50	
	sulfur		96	
	fluoride		61	
	silicon, nickel, strontium, mercury, selenium, arsenic		9	each
	lead, copper, manganese, chromium, sodium, calcium, lithium, zinc		8	each parameter
	pH in water	6	6	
	Arsenic in soil	4	4	
	Tailings	1		
	for: Arsenic, cadmium, zinc, sulfate		1	each parameter
	Lead in Hay	2	2	
	Honey bees	11		
	for : arsenic		6	
	fluoride		5	
	pollen for sulfate	1	1	

Other activities of the section :

Field sampling and data collection : a total of 65 1/2 man-days was spent on field-related activities : 18 1/2 days performing maintenance work on instruments in the field, 15 1/2 days collecting various types of samples, including assistance with source stack tests, and 31 1/2 days in the labcratory calibrating field equipment and monitors.

The laboratory helped revise the form used in the field and lab for bubbler samples - one card now replaces 6-8 sheets of paper.

Methods development: A sample splitter was obtained as the first of several needed pieces of equipment for sample preparation prior to analysis : a more representative and accurate sub-sample can now be obtained but crushing and grinding equipment to reduce the sample to small, more uniform particles prior to splitting are still needed. At present, this work is performed for us by the Montana Bureau of Mines laboratory in Butte. Both analysts spent one day there watching this procedure and inspecting their equipment. Further work on perfecting analytical methods for coal was undertaken - a nitric-perchloric acid digestion process has improved accuracy (as measured by analysis of NBS standard coal, SRM 1632.) Work was begun on adapting our methods to fly ash, using NBS standard SRM 1633. Dennis Braun spent four days at Anaconda Aluminum in Columbia Falls, working with them on improving our methods of preparing and analyzing bicarbonate tubes for fluoride. Being somewhat of a perfectionist, Dennis also spent considerable time during the year on improvements to our already good automated fluoride techniques. Both for enforcement purposes and in preparation for an impending evaluation of our facilities and program by North American Rockwell (under contract with EPA), write-ups of our methods were begun.

Quality control, legal : EPA audit samples were run for SO_2, NO_2, sulfate and nitrate. Although performance was essentially acceptable-to-good, there remains room for improvement. Talks with the EPA and literature research have given us several ideas to pursue and changes to make. Quality assurance programs have been or are being developed for other parameters and sample types not currently audited by EPA (e.g., see mention above of use of NBS standard materials for coal and fly ash analysis.) A draft of chain-of-custody procedures was written and a locking sample cabinet purchased. When the chain-of-custody procedures are implemented this should provide a strong, legally defensible method of sample handling from collection through analysis. The bees and pollen analyzed in FY 1975 made their way to court. A deposition was obtained from Tom Daly, the chemist who performed the pertinent analyses. His appearance in court may also be necessary.

Education and training : with the lack of grinding equipment, these are the weakest areas in the air quality chemistry program. Warren Norton did attend the annual APCA (Air Pollution Control Association) meeting in Portland, but this was the first such opportunity for the air chemists in four years.

Capabilities : following is a list of the analytical capability in this section.

CHEMISTRY LABORATORY BUREAU

ANALYTICAL CAPABILITY IN AIR CHEMISTRY (JULY 1976)

PARAMETER	METHOD	FIELD METHOD	MDHES PROCEDURE	NOTES
I. Airborne Particulates				
1. particle sizing	gravimetric	Anderson impactor		Added FY'74
2. total suspended	gravimetric	hi-vol filter	AQ-TSP-1	
3. nitrate	autohydrazine reduction-colorim.	hi-vol filter		
4. Benzene solubles	extraction, gravimetric	hi-vol filter		
5. sulfate	a) $BaSO_4$ turbidimetric b) methylene thymol blue-auto	hi-vol filter		in process
6. Acid aerosol	colorimetric chloranilate	membrane filter		
7. metals*	atomic absorption	hi-vol filter		*see following chart
8. fluoride	auto. colorimetric	membrane filter		
9. Dustfall	gravimetric	open bucket		
II. Gaseous Pollutants				
1. SO_2	a) $BaSO_4$ turbidimetric	PbO_2 sulfation plate	AQ-PSD-1	
	b) pararosaniline colorim.	TCM Bubbler	AQ-SOO-1a	
	c) Thorin titration	Smith-Greenberg impinger		
2. NO_2	a) NEDA colorimetric	arsenite bubbler	AQ-NOO-1	
	b) phenoldisulfonic acid colorim.	stack sampler		

PARAMETER	METHOD	FIELD METHOD	MDHES PROCEDURE	NOTES
3.acidic fluoride	a)auto colorimetric b)fluoride electrode	1)Calcium formate papers 2)Sodium formate plates 3)distilled water impinger	AQ-GFL-1	
III. Gaseous and Particulate				
1.fluoride	water extraction, auto colorim.	tape sample or $NaHCO_3$ tube		Added FY '74
IV. Vegetation				
1.fluoride	auto. alizarin fluorine blue	grab composite	VEG-TFL-1	
2.metals*	atomic absorption	grab composite		*see following chart
3.sulfur	Leco furnace, KIO_3 tit'n	grab composite		Added FY '75
V. Coal, Fly Ash, other fuels				
1.sulfur	Leco furnace, KIO_3 Tit'n	grab or composite	COA-TS-1	Added FY '74
2.BTU	adiabatic calorimeter	grab or composite		Added FY '74
3.fluoride	auto.alizarin fluorine blue	grab or composite		
4.ash	gravimetric	grab or composite		
5.moisture	gravimetric	grab or composite		
6.metals*	atomic absorption	grab or composite		*see following chart.Added FY'75
7.silicon	atomic absorption	grab or composite		

PARAMETER	METHOD	FIELD METHOD	MDHES PROCEDURE	NOTES
VI. Soil				
1.fluoride	auto,alizarin fluorine blue	grab or composite		
2.metals*	atomic absorption	grab or composite		Added FY '74
3.pH	electrometric	grab or composite		
VII. Minerals and Ores				
1.fluoride	auto.alizarin fluorine blue	grab or composite		in phosphate ore
2.metals*	atomic absorption	grab or composite		
3.sulfate	auto.turbidimetric	grab or composite		
4.carbonate	titrimetric	grab		
VIII. Water				
1.fluoride	a)auto.alizarin fluorine blue b)fluoride electrode	grab grab		
2.metals*	atomic absorption			using water quality methods; *see following chart
3.pH	electrometric	grab or impinger		
IX. Field Equipment Calibration				
1.Needle critical orifice calib.	a)rotometer b)mass flow meter	impingers	AQ-NDL-1	
2.Ozone analyzer	neutral buffer KI colorim.			
3.Fluoride tape sampler	citric acid/hydroxide		AQ-FFT-1	

CAPABILITY FOR METALS ANALYSIS, BY MATRIX*

Metal \ Matrix	Particulates	Vegetation	Coal	Soil	Minerals and Ores	Water	Notes
Antimony	X			X		X	
Arsenic	X	X	X	X	X	X	via arsine generation
Beryllium	X			X		X	
Cadmium	X	X		X	X	X	
Calcium	X		X	X		X	
Chromium	x		x	x		x	
Copper	X		X	X		X	
Iron	X			X		X	
Lead	X	X	X	X		X	
Lithium	X		X	X		X	
Magnesium	X			X		X	
Manganese	X		X	X		X	
Mercury	X		X	X		X	cold-vapor, Hg generator
Nickel	X		X			X	
Potassium	X			X		X	
Selenium	X		X	X		X	via H_2Se generation
Silver	X			X		X	
Sodium	X		X	X		X	
Strontium	X		X	X		X	
Tin	X			X		X	
Vanadium	X			X		X	
Zinc	X	X	X	X	X	X	

*Many of these metal-matrix entries have never been requested of the laboratory but, in our estimation, could be successfully analyzed if required.

Laboratory Services for Food and Consumer Safety; Occupational and General Health Chemistry

This section performed 2609 analyses on 1733 samples this past fiscal year, thus providing services to six main projects and programs, as follows :

FOOD : 305 samples, 817 determinations

1. Hamburger : 256 samples, 768 determinations

No.with positive soy	No.>20% Fat	No.>30% Fat	No.>60% Moisture	No.>70% Moisture
16	124	9	177	10

2. Bread for iron : 44 samples

3. Miscellaneous : 5 samples, 5 determinations

Montana state standards require that meat labeled as hamburger or ground beef contain no more than 20% fat and no extenders, such as soy flour. Market Samples are screened in the field by county sanitarians, and those which are questionable are sent to our laboratory for more exact testing. This past year, 48.4% of the samples we received exceeded the state statute. The program of checking for proper enrichment of bread and rolls, for which we determined iron as indicative of the remainder of the vitamins and minerals, produced no cases of insufficient or non-enrichment, and has been temporarily discontinued. Miscellaneous samples consisted of food products suspected of being chemically contaminated.

Accuracy of methods: after statistical analysis of our method for hamburger fat and moisture determination indicated that the precision (reproducibility) was higher than desirable for enforcement purposes, research of the literature and contact with the USDA led to purchase of a meat grinder and regrinding of samples when received to produce a more homogeneous sample. Statistical analysis of the new method showed that, at the 95% confidence level, our analyses of moisture and fat now are precise to within $\pm$ 0.40% and $\pm$ 0.96%, respectively: a 5-fold improvement!.

Purchase of a small freezer has increased our capacity for storing hamburger, bread, and other food samples which are awaiting analysis.

OCCUPATIONAL HEALTH : 425 samples, 749 determinations,
3 major programs, divided as follows:

A. Occupational Health Bureau, Dept. of Health : 202 samples, 519 determinations

1. Membrane filter: 179 samples, 482 analyses for :

silver	24	free silica	52
cadmium	71	zinc	100
copper	76	iron	26
manganese	26	arsenic	1
lead	106		

2. Blood: 13 samples, 24 analyses for:

cadmium	3
copper	4
lead	13
zinc	4

3. Miscellaneous : 10 samples, 13 determinations

These samples were collected by Occupational Health Bureau personnel from workers and in the work environment, and indicate the amount of exposure received on-the-job.

Method accuracy: we have participated regularly in the NIOSH (National Institute for Occupational Safety and Health, HEW) proficiency program (6 sets of samples each year), in which samples are analyzed by us for lead, cadmium, zinc, and free silica, and by Occupational Health for asbestos. Results on these tests were, until recently, our only indication of the quality of our analyses. We now have NBS Standard Reference Materials for the metals, and have obtained the procedures used by the company which prepares the NIOSH samples. Using the NBS materials and our own samples prepared by the procedures we obtained, a more frequent and thorough quality assurance program is in operation, and has provided us with the following assessment of our metals methods:

	% recovery (accuracy)	relative std. deviation
cadmium	86.6*	2.40%
lead	99.58	2.10%
zinc	97.94	2.21%

NOTE: The cadmium values, as both we and the NIOSH program have shown, are consistently low. We are seeking a purer material with which to prepare our standard solutions, and feel quite hopeful this will solve the problem. Free silica has been acceptable by NIOSH standards, but they are quite "loose". Occupational Health is asking for better precision from us to make their compliance efforts more productive and beneficial to the workers. Thus far we have expended much effort but made little headway with this analysis.

B. Worker's Compensation Division, Montana Department of Labor :
58 samples, 65 determinations

1. membrane filters : 48 samples, 55 determinations:

copper	3
iron	4
manganese	4
lead	5
free silica	38
zinc	1

2. bulk samples : 10, for : arsenic 1
lead 1
free silica 8

This testing is done on a fee-for-service basis under agreement with WCD.

C. Cholinesterase Activity in Pesticide Applicators - Food and Consumer Safety Bureau, Dept. of Health : 165 samples, 165 determinations

This is a program which monitors an applicator's exposure to the organophosphate pesticides they are applying to various crops: as exposure increases, activity(effectiveness) of the enzyme cholinesterase drops.

The applicator can then stop working with pesticides until his cholinesterase activity returns to the normal range and, hopefully, lead him to use safer procedures in his work.

We are still using pH change over time as our method of analysis; the pH-stat method would be preferable but funds have not been available to purchase the necessary instrumentation.

GENERAL HEALTH : 759 samples, 759 determinations, as follows:

Lithium in serum	1
Blood lead level	757
Lead in paint chips	1

The Montana Lead Poisoning Control Project, operated under a grant from CDC, ended December 31, 1975, and the project chemist was released, after extensive attempts to obtain continuing funding produced nothing.

Prior to the end of the project, samples were received from several projects: Children & Youth Program, Lewis & Clark County; the Department's EPSDT program, which screened several cities; the Boulder River School and Hospital; and from a joint CDC-EPA survey of Anaconda, part of a nationwide survey of smelter towns. Our analytical procedure for FEP (free erythrocyte protoporphyrin, which rises in level if a person is showing physiological effects of lead accumulation) was finally perfected late in the contract but never used on samples.

Competency, as shown by the CDC proficiency sample program, reached its peak (14 of 15 samples analyzed correctly) just before program termination. Several children had been detected with elevated blood levels, the source of lead had been identified in at least one of these cases and was being pursued in other cases. Publicity was received via an article in the Department's Treasure State Health. In short, the program was dropped just when it had reached a high level of development and was beginning to produce results. Even more disturbing than this, however, was CDC's rationale that no serious lead poisoning problems, outside of smelter towns, existed west of the Mississippi. To quote from our project's final report:

" . . . . a comparison of our data with that of New York City, as presented by Dr. Anita Curran at the Norfolk (Blood Lead) meeting. She provided a breakdown of percentages of children falling in each of the elevated categories of blood lead and FEP." Below is the comparison of NYC and Montana data :

ug/100 ml :	Class II (minimally elevated) 40-49	Class III (moderately elevated) 50-79	Class IV (extremely elevated) 80	
New York City	5.2%	1.5%	0.4%	7.1% total
Montana	3.2%	3.0%	0%	6.2% total

With the closing of the screening grant, practically all our blood lead samples now come from the Occupational Health Program : their recommended method, per NIOSH, uses a dithizone colorimetric procedure, which promises better accuracy. We have directed our efforts to developing this method but thus far have not been able to achieve the stated precision and accuracy.

PESTICIDE DISPOSAL : 242 samples, 279 determinations, as follows:
240 drum wedges for endrin (surface areas of 39 also measured)
2 drum rinsates for endrin

These samples were analyzed as part of a Pesticide Waste Disposal Demonstration Grant given by EPA to our department's Solid Waste Bureau. The first part of the project, under which these samples were analyzed, studied different methods for rinsing out empty drums, once containing pesticide formulations, sufficiently to allow their safe burial in landfill dumps. Tom Daly, as project chemist, received five days' training in the EPA and FDA pesticide labs. We finally gave up on our old Beckman GC4 gas chromatograph, selling it to Montana State University, where it will be used as spare parts for their GC4 chromatograph. The newly modified model of the Hall electrolytic conductivity detector was received and installed on our Tracor, giving us three detectors: the ECD, electron capture, and flame photometric, which now make possible the identification, verification, and quantification of practically all pesticides.

On request from the Food and Consumer Safety Bureau, we began development of methods for analyzing residual pesticides on grain crops.

CAPABILITIES AND NEEDS: Following this section, a partial list of capabilities is given: partial because several methods were developed for a particular project, used for a short while, then left as new projects were undertaken. We are fairly certain some of these have been overlooked in the current listing.

Two years ago our biggest needs were for more samples to better utilize the chemist's time, for a working gas chromatograph, and for a perchloric acid fume hood. All three objectives have been met : we have a Tracor 222 gas chromatograph, the "perc" hood, along with two others for organic solvent work, and an increased work load: excluding blood lead samples, our load history has been:

	FY '73	FY '74	FY '75	FY '76
Food & Consumer Safety	135	89	221	306
Occupational Health	45	219	616	425
Pesticide Disposal	- -	- -	- -	242
Total	180	308	837	973

Our biggest need at present is for a lab aide or technician to alleviate our chemist of such tasks as grinding hamburger, washing glassware, and evaporating down solutions prior to analysis.

Chemistry Laboratory Bureau

Analytical Capability in Food and Consumer Safety Chemistry (10/76)

MATRIX	PARAMETER	METHOD	REFERENCE	FREQUENCY	NOTES
Bread and Flour	Iron	wet washing, Atomic Absorption	AOAC(12),14.013, 14.082,14.097	RI	added in FY 1976
	Moisture	air drying, gravimetric	AOAC(12),14.082	RI	added in FY 1976
	Copper	wet ash, Atomic Absorption		E	
Hamburger and Pork Sausage	Moisture	Air drying, gravimetric	AOAC(11),24.003(b)	R	revised in FY 1976
	Fat	pet-ether extract., gravimetric	AOAC(11),24.005(a)	R	revised in FY 1976
	Soy	KOH digestion, pptn. in Ethanol	AOAC(11),24.022	R	revised in FY 1976
	Lactose and Starch	methylamine hydro-chloride, colorimetric	AOAC(11),24.007*	RI	
Paint	Lead	Atomic Absorption		E	added in FY 1975

* Starch procedure reference : Fieser & Fieser, Advanced Organic Chemistry, 1965, Reinhold, pp.963-4

Chemistry Laboratory Bureau

Food and Consumer Safety Section

Detection Limits and Quality Control Data

PARAMETER	METHOD	DETECTION LIMIT	PRECISION
Iron in bread	Atomic absorption (FCS-FEB-1)	0.25 mg/lb.	s.d. ± 0.65 mg/lb.
Moisture in bread	Gravimetric (FCS-MSB-1)		
Moisture in hamburger	Gravimetric (FCS-HM-1a)		s.d. ± 0.20%
Fat in hamburger	Solvent extraction (FCS-HF-1a)		s.d. ± 0.48%
Soy in hamburger	Ethanol precipitation (FCS-SOY-1a)		
Lactose & Starch in hamburger	Colorimetric (FCS-HLS-1)	N / A *	N / A

1 N N 1

* Qualitative test only

Chemistry Laboratory Bureau

Total Analytical Capability in Occupational Health Chemistry (10/76)

MATRIX	PARAMETERS	METHOD	REFERENCE	NOTES
Water	Gross α, β	Evaporation for counting by Occup.Hlth.Bureau		
Membrane sampling Filter	Carbonate	Titrimetric		
	Magnesium	Atomic Absorption		
	Calcium	" "		
	Chromium	" "		
	Zinc	" "		
	Iron	" "		
	Cadmium	" "		
	Lead	" "		
	Silver	" "		
	Copper	" "		
	Nickel	" "		
	Manganese	" "		
	Antimony	" "		
	Arsenic	Arsine generation, Atomic Absorption		
	Free Silica	Molybdate blue colorim.		
	Fluoride	Auto. alizarin fluorine blue		

	Phosphorus, Total	Persulfate digestion, automated single reagent	EPA, p.239	added FY 1975
	Phosphorus, Water-Sol.	Automated single reagent	EPA, p.239	added FY 1975
Bulk dust, ore, talc, clay	Free Silica	Molybdate blue colorim.		
	Arsenic	Arsine generation, Atomic Absorption		
	Lead	Atomic Absorption		
	Iron	" "		
	Chromium	" "		
Serum	Cholinesterase	Acetylcholine- ΔpH		
Charcoal collection tube	Mercury	Cold-vapor atomic absorption		
Impinger solution	Fluoride	Auto. complexone		
	Phosphorus			
	Sulfuric acid			
Welding Rods and Fluxes	Fluoride			
	Mercury			
	Lead			
	Zinc			
	Cadmium			

CHEMISTRY LABORATORY BUREAU

Analytical Capability - Health and Disease Control

MATRIX	PARAMETERS	METHOD	REFERENCE	FREQ.	NOTES
Blood	Lead	A. Delves Cup AAS		RI	
		B. Dithizone Colorim.		RI	
		C. Hessel Macro-AAS		E	HDC-BPB 1
	Cadmium	Atomic Absorption		E	
	Copper	Atomic Absorption		E	
	Zinc	Atomic Absorption		E	
	Pesticides	GC-screening		E	
Plasma	Cholinesterase Activity	Acetylcholine- ΔpH		R	HDC-CHO 1
Serum	Lithium	Atomic Absorption		E	HDC-SLI 1 a,b
	Aluminum	Atomic Absorption		EE	HDC-SAL 1 a,b
Urine	Lead			E	
	Arsenic			E	
Hair	Lead			E	
	Cadmium			E	
	Arsenic			E	

General Comments - Chemistry Laboratory Bureau

In the FY 1974 Annual Report, this section listed several needs, as follows:

- more space
- a locking refrigerator
- a perchloric acid hood
- a second distilled water still and delivery system
- a glass still
- a large-capacity demineralizer
- a programmable calculator
- revised and simplified data reporting system
- painting and general cleaning of the laboratory
- more operating money

We are very pleased to report that, with the exception of the last item, our past needs have been partially or fully met : the locking refrigerator (and a small freezer), the perchloric, plus two organic solvent hoods, the glass still, a Milli-Q4 deionizer/activated carbon unit/final filter water polishing unit, and the programmable calculator have been purchased. Part of the new distillation system (the still and storage tank) has been ordered.

An additional room was obtained when we geared up for pesticides. An Air Quality data/reporting card was revised and simplified, and reporting of food and occupational health results is now easier due to a new form and system of record-keeping. A first draft of a second form to handle multiple samples analyzed for the same parameter(s) is awaiting typing. The lab has been painted, except for the new pesticide room, and much "spring cleaning" of drawer contents, old and not presently needed chemicals and equipment, and basic grime has occurred. Our balance room was refurbished and a new balance table, 700 lb. of reinforced concrete resting on concrete block on a cement floor, was constructed by lab personnel.

Meanwhile, several safety inspections turned up serious problems for which solutions have been found or are still being sought. Small safety items, such as an adequate number of fire extinguishers and safety glasses, a fire blanket, eyewash stations, first-aid kit, etc. were purchased or otherwise obtained. The larger problems of proper acid, base, organic solvent, and gas cylinder storage facilities are still being addressed. (these inadequacies are due to improper design, made all the more remarkable since the building, constructed in the late 1950's, was to be solely a laboratory building). All gas cylinders in use in both labs (chem. and micro.) are now firmly and properly secured, and a gas cylinder storage area which comes close to meeting all specifications has been established. Through the Solid Waste Bureau's pesticide project, an explosion-proof refrigerator for sample and standard storage was obtained. The need remains, however, for facilities adequate to store our reserve supplies of organic solvents, acids, and bases. Much interdepartmental activity has occurred, but as yet no actual remodeling of storage area candidates has occurred. We are trying to "keep the pressure on" this group, and secure necessary funds for a laboratory solvent storage cabinet to hold the smaller quantities we need to have in ready reserve. The two other major deficiencies : no overhead sprinkler system and the drain being the highest point on the floor, must await the legislature's approval of our department's remodeling and expansion proposal for the Cogswell Building.

In closing, we present our new list of needs (for which we hope to write as successful a progress report in FY 1979 as has been done this year on our 1974 list) :

1. Storage facilities for organic solvents, acids, bases
2. Laboratory solvent storage cabinet
3. Still more space - water quality chemistry is now being performed in areas that were set aside for and used by air, food, and occupational health. In easing one major problem area we have created several smaller new ones.
4. New blower motor for one of the hoods. The present blower apparently lacks sufficient capacity - following use for metal digestions, it produces indoor acid "rain" for several days.
5. A second instrument (atomic absorption or Jarrell-Ash plasma emission) for metals analysis. The present AA-6 is used 8 hours per day and cannot keep up with demand.
6. A full-time laboratory aide or technician to assist in air, food, and occupational health areas. Chemists presently must wash glassware, grind their samples, and perform other sub-professional tasks because assistance is not available.
7. Completion of laboratory manuals which contain our detailed standard operating procedures.
8. The further refining and development of quality control procedures until we obtain a completely sound quality assurance program.
9. More operating money in the general laboratory budget. Needs 2 and 6, for example, in all probability won't be met till this occurs.

Laboratory services related to alcohol and abused substances.

Highway alcohol determinations - budget No. 0571
Drug screening for the Department of Institutions - budget No. 0927
Health Services - Laboratory

Highway Alcohol

Legal : Section 32-2141, R.C.M. 1947 "The Implied Consent Law"
Montana Administrative Code 16-2.26(1)-S2600 Alcohol Analysis - Quality Control
Federal Highway Program, Standard 8, Alcohol in Relation to Highway Safety

WORKLOAD

1. Laboratory Analyses

Sample	No.	No. ≥ 0.10%
1) Breath	892	811
2) Blood	838	637
3) Urine	37	31
Total	1,767	1,479

2. Alco-analyzer Field Analyses

Location	No.	No. ≥ 0.10	Refusals	Unit Proficiency*
a. Billings	429	407	133	.006
b. Kalispell	216	211	17	.005
c. Bozeman	200	188	26	.005
d. Missoula	156	154	24	.008
e. Great Falls	141	136	37	.006
f. Wolf Point	132	120	12	.003
g. Helena	110	104	61	.007
h. Glasgow	81	79	13	.006
i. Lewistown	69	66	8	.003
j. Shelby	69	55	50	.002
k. Havre	67	58	50	.002
l. Butte	65	62		.006
m. Glendive	53	45	23	.003
n. Miles City	52	50	4	.005
	1,840	1,735	428	

* Values given are unit standard deviations; acceptable values are ± 0.01% in the evaluation samples.

3. Total Alcohol Analyses for Law Enforcement Agencies

Location	No. Tested	No. ≥ 0.10%
a. Laboratory	1,767	1,479
b. Field Units	1,840	1,735
Totals	3,607	3,214

4. Court appearances = 32 These consisted of testimony in both justice and district courts. We have found it much worthwhile to foster pre-trial communication with county and city attorneys. This gives them a chance to formulate pertinent questions and lets us know what testimony will be required. The role of the laboratory witness is to present facts objectively and in such a manner as to be scientifically accurate yet be understandable to the jurors to provide them with evidence, and/or expert testimony, upon which reasonable decisions can be based.

OTHER ACTIVITIES

1. Training and certification of operators of the Alco-Analyzer Gas Chromatographs is a continuing responsibility of the program. This year the training was expanded to meet the needs of Montana Indian Tribal Law Enforcement Units. Training of operators on an additional instrument, the Smith and Wesson Breathalyzer 1000, was also provided.

2. Quality Control

a. Each Alco-Analyzer (14 locations) was inspected by a person from the laboratory, deficiencies noted, and recommendations for correction given.

b. All operators are tested for proficiency. Our laboratory sends each station solutions with alcohol content unknown to the operators. Each officer must analyze the solution according to a standard procedure. Results of the individual analyses are submitted to the laboratory where they are evaluated and a standard deviation determined for each participating unit.

c. For quality control in our laboratory, we participate in the Departmentof Transportation's (Federal) Proficiency Testing Program and, for added dimension, we also participate in Florida's Alcohol Testing Program. We also continually strive to upgrade the effectiveness of our laboratory through constant program review and monitoring.

As discussed in Laboratory Bulletin No. 65, August 20, 1976, there is concern on our part that data generated in this program isn't being fully utilized in the general attack on alcoholism. It should be used as an additional method of identifying the problem drinker.*

Other abused substances (drugs)

Through this activity we are able to provide an added dimension to the analysis of body fluids for both law-enforcement units and other agencies in the state. The Department of Institutions, through the Alcohol and Drug Division and the Corrections Divisions, is a major consumer of these services. Specific programs services are : Southwestern Montana Drug Program (SMDP), Lighthouse Project (Lighthouse), the Addictive Diseases Bureau (A.D.B.) as well as other units of the Department.

**Subsection (14) of Section 80-2711, R.C.M.1947 states "The department shall ..... (14) cooperate with department of justice in establishing and conducting programs designed to deal with the problem of persons operating motor vehicles while intoxicated." Department in this reference is the Department of Institutions.*

WORKLOAD

1. Analysis of Body Fluids

Specimens	Number received
1) Urine	822
2) Blood or Serum	85
3) Bile	1
4) Stomach Contents	1
Total	909

Analysis Done	No.	No. Positive
1) SMDP	243	22
2) Lighthouse	521	18
3) Dept. of Institutions	12	1
4) Other	133	33
Total	909	74

Drugs Found - Some samples contained more than one durg.

Sample	No. Recieved
1) Amphetamines	11
2) Alcohol	10
3) Barbiturates	32
4) Carbon Monoxide	10
5) Codeine	8
6) Morphine	4
7) Phenothiazines	3
8) Phenylpropanolamines	2
9) Propoxyphene	1
Totals	81

2. Analysis of Substances

Agency	No.	No. Positive
1) SMDP	23	15
2) A.D.B.	10	4
3) Other	26	20
Total	59	39

Drugs Found

1)	Amphetamines	14
2)	Barbiturates	5
3)	Cortisone	1
4)	Ephedrine	2
5)	Phenothiazine	1
6)	Phenylpropanolamine	2
7)	THC(Marijuana)	15
	Total	40

Supplement : Table of substances in the routine drug screen.

GENERIC NAME	BRAND NAME	DETECTION LEVEL URINE	DETECTION LEVEL BLOOD
Amobarbital	Amytal	0.1 µg/ml	.01 µg/ml
Caffeine	Cafergot	10 µg/ml	1 µg/ml
Chloridazepoxide	Librium	.05 µg/ml	.005 µg/ml
Chlorpromazine	Thorazine	.05 µg/ml	.005 µg/ml
Cocaine	- - - - -	.03 µg/ml	.003 µg/ml
Codeine	- - - - -	.03 µg/ml	.003 µg/ml
D-amphetamine	Dexadrine	.07 µg/ml	.007 µg/ml
Diazepam	Valium	.05 µg/ml	.005 µg/ml
Diphenylhydantoin	Dilantin	0.1 µg/ml	.01 µg/ml
D-propoxyphene	Darvon	0.1 µg/ml	.01 µg/ml
Glutethimide	Doriden	.07 µg/ml	.007 µg/ml
Meperidine	Demerol	.05 µg/ml	.005 µg/ml
Methamphetamine	Fetamine	10 µg/ml	1 µg/ml
Morphine	- - - - -	.03 µg/ml	.003 µg/ml
Pentabarbital	Nembutal	0.1 µg/ml	.01 µg/ml
Phenobarbital	Luminal	0.1 µg/ml	.01 µg/ml
Quinine	- - - - -	.01 µg/ml	.001 µg/ml
Secobarbital	Seconal	0.1 µg.ml	.01 µg/ml

OTHER ACTIVITIES

1. The quality of work in our drug testing activities is monitored by participation in the Toxicology Proficiency Testing Program of the Center for Disease Control. Internal quality control is carried out routinely by use of standard solutions of the various substances being tested for.

2. On request, we supply necessary sampling and mailing equipment to agencies and individuals participating in the program.

DISTRIBUTION OF TIME IN THE SECTION

Personnel hours in the Lab	4,888	85.6%
Personnel hours in the field	419	7.4%
Personnel hours on leave	401	7.0%
Total hours	5,708	100%

For fiscal year 1976 this Section analyzed 2,776 assorted samples in the laboratory and supported 1,840 field analyses; Total = 4,616. Even this large number, a 17.7% increase over fiscal year 1975, is magnified when legal responsibilities and requirements involved with each test are considered.

FINANCIAL

For the past five years, the Highway Alcohol Testing Program has been supported by grant funds to the State of Montana, Highway Safety Division, under Section 402 of the Federal Highway Safety Act of 1966. Our laboratory, in turn, operates under contract with the Montana Highway Traffic Safety Administrator with funds being mostly contributed by the Department of Transportation, National Highway Traffic Safety Administration. The amount of the contract for fiscal year 1977 is $56,721. The intention of Section 402 was to provide monies for implementation costs rather than to support projects on an ongoing basis. Therefore, this source of funding expires June 30, 1977. The program has been provided for as a line item in the executive budget of the Department of Health and Environmental Sciences for the 1979 biennium. In the "Executive Planning Process", under budget No. 0571, the request appears as follows:

Fiscal year :	1978	1979	1980	1981
	$54,353	$56,164	$63,050	$60,017

The suggestion has been made that money for this could be found in funds collected by the state from premiums on automobile insurance policies.

Most of the work in this program has been for law-enforcement agencies. This included 1,767 samples for alcohol and 87 for drugs. Of the specimens tested for alcohol content, 83.7 percent had an alcohol level equivalent to, or greater than, 0.10 percent, the legal dividing line; with the average value being 0.185 percent. From the samples tested for drugs, 16.0 percent contained an abused substance.

We are also under contract with the Department of Institutions and the Department of Community Affairs to provide drug-screening tests on body fluids for $6.00 a specimen.

For calculating costs in this bureau, we have utilized the Relative Value System (see financial section). The amount required to produce one relative value unit (RVU) in fiscal year 1976 was $2.242.

Laboratory services in determinative bacteriology.

Achromobacter xylosoxidans	2	1 vaginal, 1 wound
Acinetobacter calcoaceticus var. anitratus	20	6 wound, 4 urine, 3 sputum, 2 environment, 1 burn, 1 vaginal, 1 ear drainage, 1 frost-bite, 1 chronic obstructive pulmonary disease
Acinetobacter calcoaceticus var. lwoffi	22	5 urine, 4 wound, 4 sputum, 1 umbilicus, 1 impetigo, 1 urethra, 1 abdominal fluid, 1 neck mass, 1 eye, 1 toe drainage, 1 throat, 1 environment
Actinobacillus actinomycetemcomitans	1	neck mass
Actinomyces israelii	1	abdominal wound
Aeromonas hydrophila	1	appendix
Alcaligenes faecalis	5	3 urine, 1 wound, 1 shoulder fluid
Arizona hinshawii	1	throat
Bacillus cereus	3	wound
Bacillus laterosporus	1	knee joint fluid
Bacillus subtilis	1	throat
Bacillus sp.	23	5 abscess, 3 eye, 3 wound, 2 blood, 2 throat, 1 cervix, 1 CSF, 1 genital lochia, 1 urine, 1 dog bite, 1 tumor of bowel, 1 vagina, 1 environment
Bacteroides corrodens	6	5 wound, 1 cyst
Bacteroides fragilis	63	35 wound, 10 abscess, 8 blood, 7 body fluid, 1 bowel obstruction, 1 ulcer, 1 frost bite, 1 vagina
Bacteroides fragilis ss thetaiotaomicron	11	7 wound, 3 abscess, 1 blood
Bacteroides fragilis ss vulgatus	2	wound
Bacteroides melaninogenicus	9	3 wound, 3 body fluid, 1 abscess, 1 vagina, 1 penis
Bacteroides oralis	5	2 wound, 1 abscess, 2 blood
Bacteroides CDC Group F_1	3	2 wound, 1 vagina
Bacteroides sp.	4	3 genital, 1 body fluid
Bifidobacterium adolescentis	1	wound
Bordetella parapertussis	1	nasopharynx
Bordetella pertussis	7	nasopharynx
Branhamella catarrhalis	5	3 nasopharynx, 1 throat, 1 eye
Citrobacter diversus	1	pharynx
Citrobacter freundii	3	2 wound, 1 catheter tip
Clostridium bifermentans	2	1 wound, 1 abscess
Clostridium butyricum	2	wound
Clostridium clostridiiformis	2	1 wound, 1 mesentery
Clostridium innocuum	2	1 wound, 1 exudate
Clostridium perfringens	45	20 wound, 6 ear, 4 vaginal, 4 eye, 4 urine, 2 nasal, 2 blood, 1 placentio abruptae, 1 blister, 1 abscess
Clostridium ramosum	7	4 wound, 3 body fluid
Clostridium sporogenes	2	1 wound, 1 abscess

Clostridium subterminale	1	abscess
Clostridium tertium	3	2 wound, 1 tumor
Clostridium sp.	4	2 wound, 1 groin mass, 1 blood
Corynebacterium aquaticum	1	source not stated
Corynebacterium diphtheriae Gravis, Toxigenic	1	throat
Corynebacterium pseudo-diphtheriticum	2	1 urine, 1 sputum
Corynebacterium sp.	30	8 genital, 6 wound, 6 urine, 3 eye 1 sputum, 1 abscess, 1 CSF, 1 blood
Eikenella corrodens	13	4 body fluid, 3 wound, 3 abscess, 1 lung, 1 sinus, 1 sputum
Enterobacter aerogenes	5	4 wound, 1 pharynx
Enterobacter agglomerans	10	5 wound, 3 abscess, 1 sputum, 1 urine
Enterobacter cloacae	8	3 wound, 2 urine, 1 sputum, 1 throat 1 unidentified
Enterococcus (not speciated)	10	6 wound, 2 urine, 1 genital, 1 body fluid
Escherichia coli	68	31 urine, 11 wound, 7 body fluid, 6 abscess, 4 blood, 4 genital, 2 throat, 1 ear, 1 sputum, 1 environment
Eubacterium lentum	6	wound
Eubacterium limosum	1	blood
Flavobacterium Group IIB	4	2 abscess, 1 wound, 1 genital
Fusobacterium mortiferum	1	ruptured appendix
Fusobacterium necrophorum	1	abscess
Fusobacterium nucleatum	4	2 abdominal fluid, 2 abscess
Group 11-F	2	genital
Group 11-K type 1	1	abscess
Group IV-C(2)	1	sputum
Group TM-1	1	throat
Haemophilus aphrophilus	13	7 sputum, 3 throat, 1 maxillary sinus, 1 tracheal aspirate, 1 abscess
Haemophilus haemolyticus	1	nasopharyngeal
Haemophilus influenzae, type B	5	2 CSF, 2 nasopharynx, 1 blood
Haemophilus influenzae, not typed or not typeable	28	8 sputum, 8 nasopharynx, 5 eye, 3 throat 2 genital, 1 tracheal aspirate
Haemophilus parahaemolyticus	1	throat
Haemophilus parainfluenzae	13	6 throat, 2 nasopharynx, 1 wound, 1 sputum, 1 genital, 1 eye, 1 endotracheal tube
Haemophilus vaginalis	1	urine
Klebsiella ozaenae	3	2 throat, 1 urine
Klebsiella pneumoniae	10	2 sputum, 2 wound, 2 body fluid, 2 urine 1 blood, 1 abscess
Lactobacillus sp.	6	4 genital, 1 sputum, 1 furuncle
Listeria monocytogenes	1	blood
Micrococcus sp.	6	2 wound, 2 CSF, 1 eye, 1 sputum
Moraxella nonliquefaciens	12	7 nasopharynx, 3 throat, 1 sputum, 1 eye
Moraxella osloensis	4	1 wound, 1 throat, 1 urine, 1 genital
Moraxella urethralis	2	1 wound, 1 urine
Moraxella sp.	2	1 urine, 1 body fluid
Neisseria gonorrhoeae (sent in for identification other than N. gonorrhoeae)	1	urethra

Neisseria lactamica	1	throat
Neisseria meningitidis, Group B	5	nasal
Neisseria meningitidis, Group C	1	CSF
Neisseria meningitidis, not grouped	4	2 throat, 2 nasopharynx
Neisseria mucosa	1	wound
Pasteurella multocida	9	2 dog bite, 2 cat bite, 1 bite, 2 sputum, 1 throat, 1 abdominal wound
Pasteurella ureae	2	1 throat, 1 nasal
Peptostreptococcus CDC Group 1	19	9 wound, 7 genital, 2 absecess, 1 placental surface
Peptostreptococcus CDC Group 2	24	12 abscess, 8 wound, 2 genital, 1 body fluid, 1 hematoma
Peptostreptococcus CDC Group 3	18	8 wound, 6 abscess, 2 genital, 1 body fluid, 1 frostbite
Peptostreptococcus sp.	2	1 lung empyema, 1 uterine drainage
Propionibacterium acnes	25	11 blood, 5 abscess, 3 wound, 1 each body fluid, ear, lung empyema, mesentery, bronchial aspirate, neck mass
Propionibacterium granulosum	1	blood
Proteus mirabilis	4	1 ear, 1 colostomy, 1 urine, 1 penis
Proteus morganii	3	nasal
Proteus vulgaris	2	1 ulcer, 1 wound
Providencia stuartii	1	urine
Pseudomonas aeruginosa	25	11 urine, 4 abscess, 3 sputum, 2 wound, 2 throat, 1 body fluid, 1 nasal, 1 genital
Pseudomonas alcaligenes	4	1 sputum, 1 ear, bowel contents, 1 environmental
Pseudomonas cepacia	2	abscess
Pseudomonas fluorescens	15	5 sputum, 3 urine, 3 throat, 2 abscess, 1 genital, 1 environment
Pseudomonas maltophilia	23	11 sputum, 5 urine, 3 wound, 2 environment 1 genital, 1 ulcer
Pseudomonas picketti	1	urine
Pseudomonas pseudoalcaligenes	1	genital
Pseudomonas putida	5	1 sputum, 1 urine, 1 throat, 1 abscess, 1 environment
Pseudomonas stutzeri	2	1 wound, 1 chest drainage
Pseudomonas sp.	2	1 abscess, 1 sputum
Sarcina sp.	1	blood
Serratia marcescens	3	2 wound, 1 urine
Staphylococcus aureus	77	27 nasopharynx, 14 abscess, 10 nares, 5 skin, 4 wound, 4 eye, 3 throat, 3 umbilicus, 3 joint fluid, 2 urine, 1 genital, 1 lung aspirate
Staphylococcus epidermidis	17	5 wound, 4 abscess, 2 nares, 2 joint fluid, 2 urine, 1 blood, 1 sputum
Streptococcus faecalis	2	1 wound, 1 vaginal
Streptococcus pneumoniae	7	4 nasopharynx, 1 sputum, 1 ear, 1 abscess
Streptococcus, beta hemolytic, Group A	12	4 wound, 3 throat, 2 unidentified, 1 eye, 1 urine, 1 nasopharynx
Streptococcus, beta hemolytic, Group B	28	7 genital, 5 abscess, 4 urine, 3 wound, 2 throat, 2 ear, 1 bronchial aspirate, 1 body fluid, 1 nares, 1 blood, 1 stomach contents

Streptococcus, beta hemolytic, Group C	6	2 sputum, 2 throat, 1 tracheal secretion, 1 right antrum
Streptococcus, beta hemolytic, Group F	2	1 abscess, 1 drainage around catheter
Streptococcus, beta hemolytic, Group G	16	5 throat, 4 wound, 2 sputum, 2 abscess, 1 genital, 1 joint fluid, 1 feces
Streptococcus, beta hemolytic, not Groups A,B,C,D,F, or G	11	4 wound, 2 tracheal aspirate, 1 sputum, 1 throat, 1 body fluid, 1 feces
Streptococcus, alpha	18	6 wound, 2 sputum, 2 throat, 1 each eye, blister, bronchial aspirate, abscess, body fluid, urine, genital, blood
Veillonella alcalescens	4	1 sputum, 1 abscess, 1 bronchial aspirate, 1 body fluid
Veillonella parvula	3	2 wound, 1 bronchoscopy
Veillonella sp.	1	abscess
Xanthomonas sp.	4	1 abscess, 3 environment

965 specimens X 4.5 RVU X $2.242 = $9,736 cost of this activity

This component of the laboratory continued to serve as one of three national reference laboratories for the proficiency tests in bacteriology put out by the Center for Disease Control.

Anaerobes on the above list were mostly speciated by gas chromatography.

Laboratory services in epidemiological and clinical bacteriology.

Enteric bacteriology — Total specimens = 548

Salmonella isolated = 76* Shigella isolated = 66
Other organisms identified = 60

Enteric serogrouping procedures = 207
Enteric serotyping procedures = 26

Serotypes encountered and frequency :

Salmonella enteriditis			
Bandia	- 1	Java	- 1
Enteriditis	- 4	Rubislaw	- 1
Drypool	- 1	St. Paul	- 2
Infantis	- 3	Typhimurium	- 14
Typhimurium var. Copenhagen	- 1		

Salmonella typhi - 3 (Recovered from three cases - Indian Health Service)**

Salmonella, only grouped :

Group B	- 32
Group C1	- 4
Group C2	- 5
Group D	- 3
Group F	- 1

Shigella types encountered and frequency :

Shigella flexneri 1a	- 3
Shigella flexneri 2a	- 6
Shigella flexneri 4a	- 1
Shigella flexneri 6	- 1
Shigella flexneri, rough	- 5
Shigella flexneri, not serotyped	- 14
Shigella sonnei	- 36

* This year an isolate of a lactose positive Salmonella was encountered.
** Two of the typhoid cases were from Poplar; the other was from the Crow-Cheyenne area.

We are no longer grouping enteropathogenic E. coli when they are sent without a history.

Salmonella and Shigella isolates are no longer being referred to CDC routinely.

Total Relative Value Units = 2192 X $2.242 = $4,915 cost of this service.

Throat Cultures — Total specimens = 4,865

For *C. diphtheriae* - 407*

For beta-hemolytic streptococci - 4,458

S. pneumoniae	- 9	Group F	- 31
Group A	- 329	Group G	- 79
Group B	- 35	Not groupable	- 54
Group C	- 106	Staphylococcus spp.	- 42

* Diphtheria cases in Montana - While examining routine plates for beta-hemolytic streptococci late in October, our bacteriologist noted one that was overgrown with diphtheroids. It proved to be Corynebacterium diphtheriae, non-toxigenic. The throat culture came from the Indian Health Service Clinic in Lame Deer and the patient was symptomatic. Recalling the dictum, 'An illness clinically compatible with diptheria should be considered and reported as a case of diphtheria regardless of whether the C. diphtheriae isolate is toxigenic or non-toxigenic", this case was classified, and reported, as diphtheria; and the epidemiologist went to work to find other cases or carriers on the Northern Cheyenne Reservation. Two were found; along with 18 carriers. A total of 312 cultures were processed, of which 21 contained C. diphtheriae. This outbreak made the AP news on November 14, and on November 16, Carol Judge, the Governor's wife, urged Montanans to review their immunization records and have them brought up to date. October had been proclaimed "Immunization Action Month" by Governor Judge and special immunization clinics were held in 20 counties.

Total Relative Value Units = 11,676 X $2.242 = $26,178 cost of throat-culturing service

Miscellaneous serology

Specimens tested for brucellosis = 153 (17 positive)
Specimens tested for tularemia = 152 (5 positive)

Relative Value Units = 184 X $2.242 = $413.

Specimens for Hepatitis B (Anti-HBsAg) are referred to the Phoenix Field Station of the Center for Disease Control. Out of 131 sera sent this year, 18 were positive. The standard test used by CDC is RIA (radioimmune assay). However, CEP (counter-electrophoresis) is used as a check test on sera positive by RIA.

Specimens referred for Leptospirosis = 35
These should be sent directly to : Department of Livestock
Animal Health Division
Diagnostic Laboratory
Box 997
Bozeman, Montana 59715
(It costs us about $2.35 to handle a specimen for referral to another laboratory.)

Specimens referred to the Center for Disease Control for Cytomegalovirus inclusion disease = 53

Specimens referred to the Rocky Mountain Laboratory, Hamilton, Montana for Trachoma (or Inclusion conjunctivitis) = 9

Laboratory services related to the control of venereal disease.

Syphilis serology — Total specimens = 32,498

VDRL tests, qualitative	= 31,735		
VDRL tests, quantitative	= 1,456	(positive = 1,230)	
FTA-ABS tests	= 750	(positive = 263,	35.1%)
Spinal fluid - VDRL	= 349	(positive = 2)	

Proficiency testing : 10 specimens, four times to 75 laboratories
Approved procedures : VDRL, RPR, RST
Quality control sera will be sent to each participating laboratory.

Marriages in Montana, fiscal year 1976	= 7,143
Premarital VDRL's done in state lab	= 5,222
Live births, Montana, fiscal year 1976	= 12,463
Prenatal VDRL's done in state lab	= 6,786
VDRL's for Family Planning	= 4,686

Cultures for Neisseria gonorrhoeae 11,030 specimens (7.2% positive)

Genital smears, male = 44 positive = 6 (13.6%)

Summary of culturing by month and by program

Month	No. tested	No. positive	VD Program		Family Planning	
			No.	No. positive	No.	No. positive
July	869	45	291	38	578	7
August	1169	84	571	81	598	3
September	997	80	329	66	668	14
October	1005	82	366	73	639	9
November	770	61	220	46	550	15
December	780	60	240	45	540	15
January	904	58	262	50	642	8
February	852	79	323	64	529	15
March	920	69	325	58	595	11
April	941	45	297	36	644	9
May	891	57	286	45	605	12
June	932	73	296	60	636	13
TOTALS	11,030	793 (7.2%)	3,806	662 (17.4%)	7,224	131 (1.8%)
F.Y. 1975:	9,808	961 (9.8%)	3,180	840 (26.5%)	6,628	121 (1.8%)

Relative Value Units, this page :

Syphilis serology	=	22,210
GC bacteriology	=	8,435
		30,645 RVU

Cost : $68,699 / Total RVU: 30,645 + $2.242 = Cost to produce an RVU in our laboratory

Mycobacteriology, Parasitology, and Mycology activities

MYCOBACTERIOLOGY			
Total specimens received			4077
Total examinations			23,108
Smears	4805		
Cultures	17,428		
Biochem.	875		
Antibiotic susceptibility	81		
Cultures Referred to State	35		
Cultures Referred to CDC	20		
Mycobacterium Tuberculosis	263		
Atypical mycobacteria	41		
M. avium-intracellulare		3	
M. gordonae		20	
M. kansasii		11	
M. terrae		2	
M. xenopi		1	
M. scrofalaceum		2	
M. flavescens		1	
M. fortuitum		1	

Relative Value Units (RVU) for mycobacteriology = 13,103 @ $2.242 = $29,377

PARASITOLOGY			
Total specimens received			349
Protoza	87		
Entamoeba coli		27	
Endolimaxnana		13	
Entamoeba hartmanni		9	
Entamoeba histolytica		10	
Giardia lamblia		19	
Iodamoeba butschlii		3	
Chilomastix mesnili		5	
Dientamoeba fragilis		2	
Strongyloides larva		7	
Hookworm larvae		2	
Helminths	51		
Enterobius vermicularis		1	
Trichuris trichiura		17	
Ascaris lumbricoides		10	
Hookworm		3	
Clonorchis sinensis		1	
Hymenolepis nana		4	
Hymenolepis diminuta		1	
Taenia sp.		1	
Diphyllobothrium latum		1	
Taenia saginata proglottid			1
Plasmodium falciparum			1

Parasitology Serology

	Rec.	Pos.		
Toxoplasma	59	13	)	
Trichinosis	9	0	)	
Amoebiasis	5	0	)	
Pneumocystis	1	1	)	
Echinococcus	1	1	)	Referred to the
Malaria	4	2	)	Center for
Filariasis	1	0	)	Disease Control
Schistosomiosis	1	0	)	
Leishmaniasis	1	0	)	

Relative Value Units (RVU) for parasitology = 942 @ $2.242 = $2,112.

MYCOLOGY

Total specimens received 269

Dermatophytes:

Microsporum canis	3
Microsporum gypseum	1
Trichophyton mentagrophytes	10
Trichophyton rubrum	7
Trichophyton verrucosum	6
Trichophyton tonsurans	1
Epidermophyton floccosum	1

Systemic:

Coccidioides immitis	3
Blastomyces dermatitidis	1
Nocardia asteroides	1
Aspergillus fumigatus	1
Actinomadura dassonvillei	2

Contaminants:

Paecilomyces sp.	5
Mucor sp.	4
Rhinocladiella sp.	1
Aspergillus sp.	16
Fusarium sp.	1
Alternaria sp.	3
Stemphylium sp.	2
Cladosporium sp.	11
Phoma sp.	1
Penicillium sp.	14
Macrosporium sp.	1
Rhizopus sp.	1
Tricothecium sp.	1
Scopulariopsis sp.	4
Cephalosporium sp.	1

Subcutaneous:

Streptomyces sp.	1
Sporothrix schenkii	2
Fonsecaea pedrosoi	1
Phialophora jeanselmi	4
Cladosporium carrionii	1
Cladosporium werneckii	1
Aureobasidium pullulans	1

Yeasts:

Candida albicans	47
Candida guillermondii	3
Candida krusei	2
Candida parapsilosis	10
Candida tropicalis	5
Candida uniguttulatus	2
Cryptococcus neoformans	2
Cryptococcus laurentii	1
Cryptococcus albidus v. diffluens	1
Torulopsis glabrata	13
Trichosporon cutaneum	3
Trichosporon capitatum	1
Rhodotorula sp.	6
Saccharomyces cerevisiae	5

*Mycology Serology — Total Received 65

	Rec.	Pos.
Blastomycosis	60	6
Cryptococcosis	3	1
Sporotrichosis	1	1
Candidiasis	3	2
Histoplasmosis	60	3
Coccidioidomycosis	60	1

* Referred to the Center for Disease Control

Relative Value Units (RVU) for mycology = 2382 @ $2.242 = $5,340.

Total for testing in this section : $36,829.

Virology

Total specimens processed through the virus laboratory = 24,003
For virus isolation by inoculation of tissue cultures or eggs = 347
For serologic testing = 23,656
Source of viral isolation specimens : Enteric - 61, Respiratory - 90, Other - 27, (tissue, urine, vesicle fluid)
Procedures : Tissue-culture hosts - 217, Eggs - 130

	SEROLOGY		VIRUSES
	No. Tested	No. Positive	ISOLATED
Influenza Group A (CF)	205	46	22
Influenza Group A (HAI)	22	19	
Influenza Group B (CF)	205	0	0
Influenza Group B (HAI)	22	0	
Adenovirus	284	2	1
Mycoplasma pneumoniae	158	21	not done
Mumps (meningoencephalitis)	36	1	0
Rubeola	195	54	0
Colorado Tick Fever	134	13	3
Rocky Mt. spotted fever	145	0	0
Q fever	14	0	0
Western Equine Encephalitis	72	3	0
St. Louis Encephalitis	75	1	0
Rubella (diagnostic specimens)	195	22	0
Infectious mononucleosis (Ox-cell)*	118	33	
Typhus	5	0	
Rickettsialpox	5	0	
Herpes simplex	191	18	5

* Ox-cell hemolysin test was discontinued July 1, 1976.

Influenza : On page 11 of the annual report for fiscal year 1975, there appeared a listing of influenza outbreaks in Montana, 1956-1975. Add to this - 1976 - A/Victoria/'75 (H3N2) - Our index case had an onset date of February 10; one month later than in the mild epidemic of 1975. Judging from the number of specimens received, the outbreak reached a peak sometime between February 23 and March 3. The last date of onset for a laboratory-confirmed case was April 6. However, we have had reports of a few cases after that. Twenty-two strains of influenza virus were isolated and sent to the WHO Influenza Laboratory at the Center for Disease Control. This year's epidemic seemed to be more severe clinically than others in recent years. Particularly noticeable was the high incidence of complications.

Because of current interest, we are including results of a survey for hemagglutination-inhibition antibodies for influenza.

MONTANANS TESTED MAY 25, 1976 - OCTOBER 18,1976

Number of persons with antibody titers:

1:10-20	1:40-320	1:10-20	1:40-320	1:10-20	1:40-320
A/Victoria/'75		A/New Jersey/'76		B/Hong Kong/'72	
469/949(49%)	210/949(22%)	105/949(11%)	69/949(7%)	206/817(25%)	58/817(7%)

A few individuals have been encountered with titers of 1:160-320 for A/N.J./'76. This suggests infection of man with this virus in recent years. Perhaps, if we keep trying, we may be able to recover an isolate with this antigenic formula. We also find persons with high titers for B/Hong Kong/'72; just enough to remind us that this virus is still around. Morbidity & Mortality Reports for October 22 mentions the death of a 32-year old man in Scotland as being due to infection with Group B influenza virus. This may be a virus to watch out for in '77! The latest reported epidemic has been on Guam this fall. Thirty-four isolates of A/Victoria/'75 have been made during the outbreak.

Laboratory services for rubella screening program - Viral serology

Tests for immunity to RUBELLA are required by Montana Administrative Code 16.2.26 (2)-S2620 (Sec. 48-137, R.C.M. 1947 - Premarital); MAC 16-2.18(6)-S1840 (Sec. 69-6701 through 69-6703, R.C.M. 1947 - Prenatal); and the family planning program. A return, post-card questionnaire accompanies each negative report. Recommendations are given on the card. They are returned to our Preventive Health Services Bureau. Also, a list of negative reactors is sent to the Bureau each week. Here is a tabulation of rubella hemagglutination-inhibition tests (HAI) performed this year. They are set up once a week in batches of 400 to 500 specimens using a microtiter procedure.

Month	Number Tested	Number non-immune	Prenatal	Premarital	Family Planning	Diagnostic	Other
July	1827	273	487	915	315	11	99
August	2189	250	1058	689	351	17	74
September	2173	249	883	766	464	10	50
October	1569	136	619	513	360	3	74
November	1492	186	657	494	285	8	48
December	1549	179	691	561	274	2	21
January	1477	107	752	330	305	4	86
February	1529	198	777	288	401	14	49
March	2036	215	982	540	386	27	101
April	1842	215	690	451	608	45	48
May	2260	224	883	832	455	25	65
June	2022	197	742	897	318	29	36
TOTALS	21,965	2,429 (11.1%)	9,221	7,276	4,522	195	751
1975 Report :	18,945	2,100 (11.1%)	7,671	6,147	4,126	149	806

Relative Value Units; this activity = 13,179 @ $2.242 = $29,547

Screening of newborn for inborn errors of metabolism.

Testing is done in the Public Health Laboratory, Health Division, Department of Human Resources, State of Oregon. Under the terms of the contract, specimens are screened for phenylketonuria, maple syrup urine disease, galactosemia, tyrosinemia, homocystenuria, and hypothyroidism. When abnormal findings are obtained, we are notified by telephone; and in turn contact the attending physician. There is also provision for consultation with Neil R. M. Buist, M.D., Associate Professor of Pediatrics and Medical Genetics, University of Oregon Health Sciences Center. If a medical emergency is indicated, Dr. Buist calls the physician directly. The contract price for all of this is $2.00 per specimen; repeat specimens are tested free of charge. The basic contract for fiscal year 1977 is for $24,000.

Specimens = 12,534 Number of tests = 87,851

Confirmed : Two cases of congenital hypothyroidism. (Oregon recently reported their thirteenth case of hypothyroidism in newborn since it was added to the screening program - for a ratio of 1:5,270.)
A delayed case of phenylketonuria, and elevated levels of phenylalanine in twins (not classified as true PKU).

Live births, Montana, fiscal year 1976 = 12,463

Current population estimate for Montana = 748,000

Montana was among the first group of states to require testing for PKU when the 1965 session of the legislature passed the bill which became Section 69-4116, R.C.M. 1947. Bud Brown from the state laboratory had been to Dr. Guthrie's laboratory in Buffalo in 1963 to acquire skill with the Guthrie metabolism-inhibition technique. This was a work-shop conducted for state laboratory personnel and Montana was represented in the first contingent. The final legislation extending the program to include metabolic defects other than PKU became law when Governor Thomas L. Judge signed house bill No. 261 on March 8, 1973. This is Section 69-6710 through Section 69-6713, R.C.M. 1947.

Since the beginning, this program has been financed by federal funds granted to the Maternal & Child Health Bureau. However, starting with the 1979 biennium, this must be transferred to the regular executive budget. Provision for the program has been made in the "Executive Planning Process" under budget No. 0927 and dollar amounts will be stored under "Early Detection and Treatment - Infant Screening Program". There are two elements which enter into this: cost of the contract with Oregon, and our cost for administering the program. Here are the total amounts requested :

Fiscal year :	1978	1979	1980	1981
	$40,754	$42,905	$45,178	$47,581

This is a viable program in preventive medicine which is operating well, and I would classify it as one of our more successful ones. In my opinion, it should be assigned a high priority in zero-based budgeting.

Sanitary and Environmental Microbiology

Food Microbiology

Origin of samples processed :

Consumer complaints	47	samples
Food Poisoning	39	"
FDA proficiency tests	7	"
Ground Beef	230	"
Rodac	21	plates
Air control	42	"
Total	386	

Procedures used for analyzing the samples :

Aerobic plate count	248
Aerobic plate count, 4°C	6
Coliform MPN	15
E. coli MPN	266
Coagulase positive staphylococci MPN	71
Salmonella	19
C. perfringens	44
Can analysis	8
Direct smear	28
Viable growth - identification	31

Food microbiology involves testing samples as a possible source of food poisoning to support epidemiological investigations and performing tests for bacteriological quality as required for sanitary inspections and follow-up of consumer complaints. A major project this year has been the testing of ground beef for E. coli and total bacterial count (aerobic plate). Two hundred thirty samples from retail outlets were processed. An analysis of these results is available from the Food and Consumer Safety Bureau. Even though the FDA samples for proficiency testing in food bacteriology arrived in unsatisfactory condition, they were tested as a teaching aid. Results were not reported to FDA as official ones. They have assured us that next year better transportation will be arranged for getting the samples to Montana in satisfactory condition.

Relative Value Units = 2,046 @ $2.242 = $4,587 (includes preparation of sample)

Water Microbiology

Delineation of samples processed :

Private supplies	2,679	samples
Municipal supplies	8,739	"
Federal Agencies	1,700	"
State Agencies	493	"
Raw-source water for municipal supplies	330	"
For determination of water quality	298	"
Recreational waters	9	"
Rural schools	154	"
For specific pathogens (Yersinia, Shigella)	16	"
Distilled water for suitability tests	17	"
For identification of iron bacteria	9	"
Ice	1	sample
Total	14,445	

Procedures used for analyzing the samples :

Multiple tube, potable water, total coliform tests (Presumptive - confirmed, 5 tube)	8,135
Multiple tube, potable water, fecal coliform tests	58
MPN raw water, total coliform tests	340
MPN raw water, fecal coliform tests	67
Multiple tube, completed tests	12
Membrane filter, potable water tests (100 ml sample)	5,640
Membrane filter, raw water, fecal coliform tests	312
Membrane filter, raw water, fecal streptococci tests	125
Verification membrane filter tests	45
Membrane filter, raw water, total coliform tests	114
Identification of iron bacteria	9
Plate count, raw waters (48 hr., 35°C)	112
Turbidity, potable waters	891
Cultures for enteric pathogens	16
Tests for bacteriological suitability	17

Abnormal findings :

Presumptive positive tests	1965	
Confirmed positive tests	1437	(73%)
Municipal samples, confirmed positive	149	(4.8%)
Private samples, confirmed positive	703	(26.2%)
Federal agencies, confirmed positive	195	(11.4%)
State agencies, confirmed positive	71	(14.4%)
Rural school samples, confirmed positive	30	(19.6%)
Membrane filter, potable water tests positive	143	(2.5%)

Relative Value Units = 34,356 @ $2.242 = $77,026

There are 15 laboratories involved in surveillance of drinking water supplies for compliance with Federal Drinking Water requirements. Seven of these laboratories were inspected and certified under "Interstate Carrier" regulations.

Again, in May, the training conference on wastewater analysis (chemistry and microbiology) was held in the laboratory. Fifteen people from local laboratories involved in effluent monitoring attended the week long session. The response to these conferences has been excellent and already there are people on the waiting list for the next one. The Manpower & Training Divsion of EPA, Region VIII, supported the conference with $3,044 in grant funds. This was used to help with the travel and lodging expenses of the trainees and to buy some training equipment.

The head of the Environmental Microbiology section represented the six states in Region VIII at a meeting on laboratory certification held in July in Chicago.

In February, John Manhart, EPA Region VIII water microbiologist, inspected and evaluated the section. He found the general quality of the water microbiology laboratory staff, and their analytical output, to be excellent.

The total value of tests, based on Relative Value Units, conducted in the Environmental Microbiology Section for fiscal year 1976 was $81,813. However, the amount appropriated to the section (0670) was $81,875!

Activities concerned with laboratory improvement.

Registration of laboratories is carried out under the provisions of Montana Administrative Code - Chapter 26 - Sub-Chapter 2 Microbiology Laboratory - Section 16-2.26(2)-S2610 APPROVAL OF LABORATORIES. The effective date of this regulation was July 1, 1935. Although intended originally to apply mainly to laboratories performing serological tests for syphilis and bacteriological tests for quarantinable diseases, the wording is sufficiently ambiguous so it can be interpreted to apply to all medical laboratories.

Laboratories registered with the Department = 109
Hospital laboratories = 69
Clinical laboratories = 40

Excluded from the above are laboratories serving fewer than three physicians, facilities operated by the Federal Government in Montana, and those laboratories engaged in teaching and research only.

*Tests performed in registered laboratories :

Urinalysis	327,207
Clinical Chemstrip	1,713,332
Hematology	1,209,155
Blood Grouping	46,110
Rh typing	42,462
Bacteriology	267,839
Mycology	2,296
Parasitology	5,002
Serology (non-VD)	65,389
Virology	1,340
Anatomical Pathology - Surgicals	54,576
Anatomical Pathology - Necropsies	947
Cytology	88,734
Radioisotopes	33,155
ECG	32,618
Cross match	23,267
Other	73,667
	3,976,875

* Each year the Hospital and Medical Facilities Division requires the completion of a statistical form which includes the above data. However, data was received for 94 laboratories only. Our estimate for total number of laboratory procedures carried out in registered facilities, therefore, is : 4,624,273.

Registration of personnel performing laboratory tests is carried out under the same regulation.

Persons performing medical and public health laboratory tests in Montana who are registered with the Department = 504
Categories in which personnel are registered are : Clinical Laboratory Director, Clinical Laboratory Supervisor, Clinical Laboratory Technologist, Cytotechnologist, and Clinical Laboratory Technician. Provision is made on the forms for listing specialties. Exempted from registration are :

a. Physicians and dentists licensed to practice in the State of Montana.
b. Persons employed in laboratories operated and maintained exclusively for research and teaching purposes, involving no patient or public health services whatsoever.
c. Persons employed in clinical and research laboratories operated by the United States Government.

We, in the Laboratory Division, administer the National Proficiency Examinations for Qualification as a Clinical Laboratory Technologist or Cytotechnologist. They are authorized by Public Law 92-603, the Social Security Amendments of 1972. These have already been given three times; the fourth, and last, session will probably be held in December 1977. Here are the figures for sessions held so far :

	Number taking the test		Number achieving a passing grade	
	Technologist	Cytotechnologist	Technologist	Cytotechnologist
March 1975	28	3	9 (32%)	1 (33%)
November 1975	25	3	16 (64%)	2 (66%)
October 1976	38	(Nov.) 1	Results not yet received	

Certification of Laboratories : Each January a compilation of laboratories certified by the Department for various procedures is issued. The January 1976 edition contained the following :

a. Laboratories approved for serological tests for syphilis - 71
(On the basis of performance in our proficiency tests.)
b. Laboratories approved for bacteriology - our proficiency test - 33
c. Laboratories not included in (b.) but which satisfy Medicare requirements by participating in a state-approved system - 19
d. Installations approved for breath alcohol analysis - 14
e. Laboratories approved for drinking-water bacteriology - 12
(Seven of these are inspected and certified under the "Interstate Carrier" regulations.)

Continuing education : One-week bench training in clinical microbiology is given under arrangements with the Montana Medical Education & Research Foundation. (Individual scheduling for 20 students.)

One-week training conference on waste-water analysis. Usually conducted two times a year.

Lecture-discussions conducted by members of the laboratory staff. The staff gave twelve this year.

The various sections of the state laboratory participate in over 18 national proficiency tests.

During the year, eight persons from the professional staff attended conferences, training sessions, or planning meetings conducted out-of-state by the Environmental Protection Administration, the Center for Disease Control or some other Federal Agency.

FINANCIAL

As suggested in the report for fiscal year 1973, we are using the relative value system for calculating the costs of tests in the microbiology laboratory bureau. (Diagnostic Workload Measurement - A Relative Value Structure for Public Health Laboratories: Volumes I & II, September 20, 1973, U. S. Dept. of HEW, Center for Disease Control, Bureau of Laboratories, Atlanta, Georgia 30333)

Recalculated figures for costs of tests are given in the listing of tests done for the Indian Health Service for fiscal year 1976. There is no reimbursement to the state for these services. (A complete cost-fee schedule for tests done in the laboratory division is available on request. pp 31, 31A, 31B of the C.A.R.)

Laboratory testing carried out for the Indian Health Service; fiscal year 1976

TEST	COST	NUMBER	VALUE
Throat cultures for beta-hemolytic streptococci	@ $1.35	116	$156.60
Screening of newborn for inborn errors of metabolism	@ $4.00	322	1,288.00
Culture for M. tuberculosis & other acid-fasts	@$10.00	1,745	17,450.00
Antibiotic sensitivity test on mycobacteria	@ $7.25	49	355.25
Culture for bacteria and identification	@ $5.80	560	3,248.00
Determinative bacteriology	@$10.10	59	595.90
Rubella hemagglutination-inhibition(prem.& pren.)	@ $1.35*	837	1,129.95
Tissue culture for detection of viruses	@$19.50	21	409.50
Serological tests for viral antibodies	@ $5.10	54	270.00
VDRL for syphilis	@ $1.35	4,723	6,376.05
FTA-ABS for syphilis	@ $5.00	93	465.00
Tularemia-brucella agglutination test	@ $2.70	3	8.10
Test for infectious mononucleosis(ox-cell hemo.)**	@ $2.30	3	6.90
Parasitology	@ $6.75	160	1,080.00
Culture for Neisseria gonorrhoeae	@ $2.50	126	315.00
Bacteriological analysis of drinking water	@ $4.00	89	356.00
Mycology	@ $6.75	99	668.25
Food microbiology	@$11.88	- -	- - - -
Totals		9,059	$34,178.50

(For statistics on Indian population in Montana - see page 16 of the fy '75 report.)

* For two-dilution screening tests done by microtiter procedure in batches of about 400 specimens.

** Ox-cell hemolysin test for infectious mononucleosis discontinued July 1, 1976.

Salaries in the laboratory division :

POSITION TITLE	Annual Salary	POSITION TITLE	Annual Salary
Administrator, Lab.Div.	$22,726	Chemist II	$12,203
Chief, Chem.Lab.Bur.	19,580	Microbiologist II	12,203
Chief, Micro.Lab.Bur.	19,580	Chemist I	11,369
Chemist IV	14,991	Microbiologist I	11,369
Microbiologist IV	14,991	Lab. Technician III	11,369
Chemist III	13,693	Lab. Technician II	10,373
Microbiologist III	13,693	Lab. Technician I	9,454
		Lab. Aide II	8,222
		Lab. Aide I	7,159

* Additionally, there is an average of $2,080 per year in employee benefits ($1.00 per hour).

BUDGET SUMMARY :

Budget - number & title	Expenditures			Income	
	Personnel & Benefits	Operating & Equipment	TOTAL	Federal	State
0370 - Communicable Disease Control, Micro Lab	$95,249	$7,914	$103,163	$36,517	$66,646
0927 - Health Services, Micro	14,688	8,569	23,257	10,257	13,000
0570 - Health Care Facilities, Micro Lab	56,173	4,216	60,389	42,289	18,00
0571 - Highway Alcohol Determinations	36,799	12,334	49,133	49,133	- - -
0670 - Environmental Health, Micro Lab	45,426	21,922	67,348	27,216	40,132
0675 - Environmental Health, Chemistry Lab	37,598	19,526	57,124	50,424	6,700
Totals	$285,933	$74,481	*$360,414	$215,836	$144,578
	80%	20%	100%	60%	40%

* This budget covers 20.9 Full-Time Equivalents (F.T.E.). Additionally, there are 9.1 F.T.E. working in the laboratory who are supported under other budgets : TB control, Family Planning, Air Quality, Water Quality, Licensing & Certification.

Budget projections for the next five years from the "State of Montana - Executive Planning Process".

Budget	1977	1978	1979	1980(4)	1981(4)
0370	$106,521	$117,900	$122,000	$112,908	$115,674
0927	52,500(1)	59,369	63,197	62,460	65,566
0570	61,554(2)	64,962	66,934	71,378	73,381
0571	51,353(3)	52,959	55,289	63,050	60,017
0670	59,822	63,414	66,527	71,104	73,449
0675	47,579	53,052	57,019	50,000(5)	51,500(5)
TOTALS	$379,329	$411,656	$430,966	$430,900(4)	$439,587(4)

(1) $24,000 added to pay the contract with Oregon for infant screening.
(2) These amounts will decrease as shifts to other budgets occur.
(3) Beginning with the next biennium, this will be changed from federal to state funding
(4) The figures for 1980 and 1981 have not been adjusted for increases in salaries and benefits.
(5) Does not include proposed "expanded" programs.

There isn't sufficient allowance for inflation in these budgets. However, it should be possible to decrease services offered in the state laboratory as quality of performance improves in clinical laboratories and costs are underwritten by some form of national health insurance. Increased funding of local health departments should also enable them to expand their services.

STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
HELENA, MONTANA 59601
LABORATORY DIVISION